CLAIMS

What is claimed is:

1. A photodetector, comprising:

a plurality of semiconductor materials forming a heterojunction, the plurality of semiconductor materials comprising:

a first semiconductor material;

a second semiconductor material coupled to the first semiconductor material, the first and second semiconductor materials being halides.

2. The photodetector of claim 1, wherein the first and second semiconductor materials have approximately the same band gap.

3. The photodetector of claim 1, wherein the first semiconductor material comprises an iodide compound and the second semiconductor material comprises mercuric iodide.

4. The photodetector of claim 3, wherein the first semiconductor material comprises lead iodide.

5. The photodetector of claim 1, further comprising:

a first contact; and

a second contact, wherein the first plurality of semiconductor materials are disposed between the first and second contacts.

6. The photodetector of claim 5, wherein at least one of the first and second contacts comprises palladium.

7. The photodetector of claim 5, wherein the second semiconductor material comprises mercuric iodide and the first semiconductor material is less chemically reactive than mercuric iodide with the contacts.

8. The photodetector of claim 1, wherein the second semiconductor material is thicker than the first semiconductor material.

9. The photodetector of claim 8, wherein the first semiconductor material has a first thickness less than approximately 250 microns.

10. The photodetector of claim 9, wherein the first semiconductor material has a first thickness less than approximately 50 microns.

11. The photodetector of claim 4, wherein the second semiconductor material is thicker than the first semiconductor material.

12 The photodetector of claim 11, wherein the first semiconductor material has a first thickness less than approximately 250 microns.

13. The photodetector of claim 12, wherein the first semiconductor material has a first thickness less than approximately 50 microns.

14. The photodetector of claim 4, wherein the plurality of semiconductor materials further comprises a third semiconductor material comprising lead iodide coupled to the second semiconductor material.

15. The photodetector of claim 14, wherein the third semiconductor material has a third thickness less than approximately 50 microns.

16. The photodetector of claim 1, wherein the second semiconductor material has a conductivity type different than the first semiconductor material.

17. The photodetector of claim 16, wherein the band gaps of the first and second semiconductor materials are within 10 percent of each other.

18. The photodetector of claim 17, wherein the first semiconductor material comprises mercuric iodide and the second semiconductor material comprises lead iodide.

19. The photodetector of claim 18, wherein the second semiconductor material is thicker than the first semiconductor material.

20. The photodetector of claim 18, wherein the plurality of semiconductor materials further comprises a third semiconductor material comprising lead iodide coupled to the second semiconductor material.

21. The photodetector of claim 1, wherein at least one of the first and second semiconductor materials comprises an iodide compound and wherein the first semiconductor material comprises bismuth iodide.

22. The photodetector of claim 21, wherein the second semiconductor material comprises mercuric iodide.

23. The photodetector of claim 21, wherein the first semiconductor material comprises lead iodide.

24. The photodetector of claim 1, wherein one of the first and second semiconductor materials comprises an iodide compound and the other of the first and second semiconductor materials comprises thallium bromide.

25. The photodetector of claim 24, wherein the one of the first and second semiconductor materials that comprises an iodide compound further comprises mercuric iodide.

26. The photodetector of claim 24, wherein the one of the first and second semiconductor materials that comprises an iodide compound further comprises lead iodide.

27. The photodetector of claim 1, wherein the photodetector is coupled to a negative bias.

28. The photodetector of claim 5, wherein the first contact is coupled to ground and the second contact is coupled to a negative voltage.

29. The photodetector of claim 8, wherein the first contact is coupled to ground and the second contact is coupled to a negative voltage.

30. A photodetector, comprising:

a first semiconductor material;

a second semiconductor material coupled to the first semiconductor material forming a heterojunction structure;

a contact coupled to the second semiconductor material, wherein the first and second semiconductor materials comprise means for reducing a chemical reaction with the contact; and

means for reducing dark current in the heterojunction structure.

31. A photodetector, comprising:

a first semiconductor material; and

a second semiconductor material coupled to the first semiconductor material; and

a contact coupled to the second semiconductor material, wherein the second semiconductor material is less corrosive than the first semiconductor material to the contact.

32. The photodetector of claim 31, wherein the first and second semiconductor materials are halides.

33. The photodetector of claim 32, wherein the first and second semiconductor materials comprise iodide.

34. The photodetector of claim 33, wherein the first semiconductor material is lead iodide.

35. The photodetector of claim 34, wherein the second semiconductor material is mercuric iodide.

36. The photodetector of claim 33, wherein the second semiconductor material is mercuric iodide.

37. The photodetector of claim 33, wherein the first semiconductor material is bismuth iodide.

38. An x-ray detector, comprising:

a flat panel detector comprising an array of photodetectors, wherein the array of photodetectors comprises:

a plurality of semiconductor materials forming a heterojunction, the plurality of semiconductor materials comprising:

a first semiconductor material;

a second semiconductor material coupled to the first semiconductor material, wherein the first and second semiconductor materials are halides.

39. The x-ray detector of claim 38, wherein each of the photodetectors in the array further comprise:

a first contact; and

a second contact, wherein the first plurality of semiconductor materials are disposed between the first and second contacts.

40. The x-ray detector of claim 39, wherein the second semiconductor material comprises mercuric iodide and the first semiconductor material is less chemically reactive than mercuric iodide with the contacts.

41. The x-ray detector of claim 40, wherein the second semiconductor material is thicker than the first semiconductor material.

42. The x-ray detector of claim 41, wherein the first semiconductor material comprises lead iodide.

43. The x-ray detector of claim 41, wherein the first semiconductor material comprises bismuth iodide.

44. The x-ray detector of claim 41, wherein the first semiconductor material comprises thallium bromide.

45. The x-ray detector of claim 40, wherein the photoconductors are negatively biased.

46. A method, comprising:

depositing a first conductor above a substrate;

depositing a first semiconductor material above the second conductor;

depositing a second semiconductor material above the first semiconductor material, wherein the first and second semiconductor materials comprise halides; and

depositing a second conductor above the second semiconductor material.

47. The method of claim 46, wherein the first semiconductor material comprises an iodide compound and the second semiconductor material comprises mercuric iodide.

48. The method of claim 46, wherein one of the first and second semiconductor materials comprises an iodide compound and the other semiconductor material comprises thallium bromide.